



Delta MVD 1000 Series

Medium Voltage Drive



www.delta.com.tw/mvd



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Delta's solar energy system covers the 2009 World Games Stadium.

Delta Group

Delta Group is the world's leading provider of power management and thermal management solutions, as well as a major source for components, visual displays, industrial automation, networking products, and renewable energy solutions. Delta Group has sales offices worldwide and manufacturing plants in Taiwan, China, Thailand, Japan, Mexico, India, Brazil and Europe. As a global leader in power electronics, Delta's mission is, "To provide innovative, clean and efficient energy solutions for a better tomorrow." Delta is committed to environmental protection and has implemented green, lead-free production and recycling and waste management programs for many years.

For more information about Delta Group, please visit: www.deltaww.com.

Why Drives Matter

Drives can save an average of 40% of the electricity a motor uses as well as reduce related CO₂ emissions. Since industry accounts for one-third of the world's electricity consumption and electric motors consume 65% of industrial electricity in regions such as the EU [1], the potential global energy savings from a wider use of drives would be substantial. For an industrial enterprise, drives can reduce energy costs, reduce start-up current stresses on the grid, minimize wear on motors and other mechanical equipment, and reduce maintenance costs. A reliable, high-performance drive such as Delta's MVD 1000 medium voltage drive can provide an enterprise with greater energy-savings as well as increased productivity.

[1] "Energy Efficient Motor Driven Systems," European Copper Institute, Fraunhofer-ISI, KU Leuven and University of Coimbra (April 2004)

Delta MVD 1000 Series



The Delta MVD 1000 series medium voltage drive is an energy-saving solution for general-purpose motor control applications.

This drive provides reliable variable-speed control and enhances productivity by significantly reducing energy costs, equipment maintenance and motor wear.

The Delta MVD 1000 series is a highly integrated, easy-to-use and flexible solution for end-users and solution providers.



Advanced Features & Benefits

Leading Technology

- Multi-pulse input rectification reduces input current harmonic distortion, meeting IEEE 519-1992
- Advanced drive concept provides multilevel output voltages and enhanced motor operation
- Enhanced input power quality ensures input power factor above 96% in the speed control range

Protection Features

- Over-current
- Overload
- Under/Over voltage
- Transformer over-temperature
- Low system voltage
- Motor protection via external signals
- Drive over temperature
- Cooling fan abnormal
- Cabinet door open alarm
- Internal cabinet pressure monitoring
- Output short circuit
- Input / Output Phase loss
- Phase-to-ground fault
- Communication error

Enhanced Process & Quality Control

- Built-in proportional integral differential (PID) controller enhances control of process variables such as flow and pressure
- Ride through and flying start features ensure a more continuous process in spite of input voltage dips
- Easily integrated with customer's upper level control

Control & Monitoring Features

- Frequency reference (Hz)
- Actual frequency (Hz)
- Input / Output power / current / voltage
- Operation hours
- Drive status
- Status of system bypass switches and MCB
- Analogue inputs / outputs monitoring
- Fault / Alarm messages
- Fault diagnosis function
- Ride-through and flying start functions

Lower Cost of Ownership

- Reduced power loss maintains overall efficiency above 96.5% (including transformer) and minimizes operating costs over the drive's life cycle
- Optimized pump and fan operation ensures significant energy savings and shortens the return on investment
- Integrated transformer enables a three-cables-in-three-cables-out installation concept using considerably less engineering effort
- Reduced mechanical stresses eliminates hammer effect in pipelines, and lowers maintenance cost
- Multilevel voltages, controlled current start-up, and smooth response to load step minimize motor stresses

Major Applications

Power Generation	Forced draft fan, induced draft fan, boiler feed-water pump, cooling water pump, compressor, circulation water pump, compressor, condensator pump
Oil & Gas	Gas compressor, electrical submersible pump, pipeline pump, brine pump, feed-water pump
Mining	Ventilation fan, baghouse fan, slurry pump, feed pump, gas compressor, blast furnace fan
Metallurgy	Forced draft fan (FDF), induced draft fan (IDF), baghouse fan, descaling pump, feed-water pump, booster pump, coiler blast, furnace fan, gas compressor
Cement	Kiln IDF, baghouse fan, separator fan, raw mill IDF
Public Facilities	FDF, IDF, raw sewage pump, freshwater pump, feed-water pump



Reduced Energy Consumption & CO₂ Emissions

For many applications the Delta MVD 1000 can provide significant reductions in energy consumption and CO₂ emissions. The example below shows the benefits of using the MVD 1000 for two forced draft fans in one of the world's leading steel companies.

Application: Two Forced Draft Fans (FDF) at a world leading steel company using Delta MVDs

Specifications	FDF 1 / FDF 2
Rated fan power	4300 kW
Total hours 2010	7105 Hrs
Rated speed	890 RPM
Rated voltage	10000 V
Rated motor power	4400 kW
Rated current	305 A
CO ₂ emissions	0.637 eq/kWhr

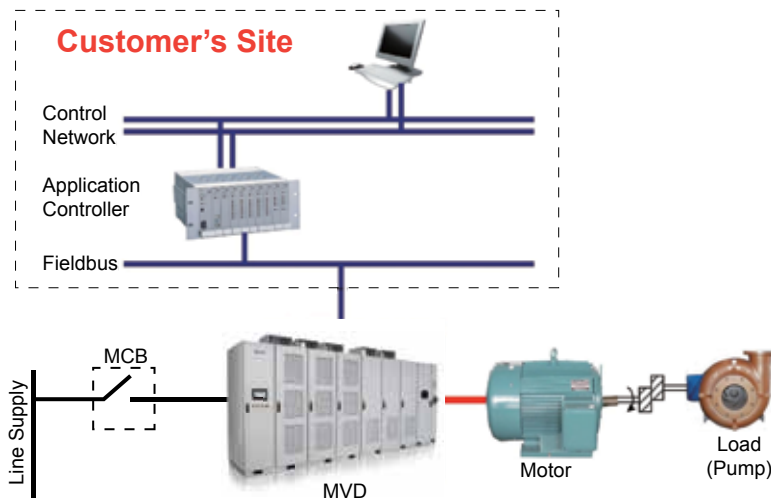
Energy Savings Comparison (MVD vs. Damper)

Motor	FDF 4-1	FDF 4-2
Energy usage (Damper)	2311 kW/yr	2350 kW/yr
	16,560,255 kWh/yr	16,700,073 kWh/yr
Energy usage (MVD)	893 kW/yr	968 kW/yr
	6,343,167 kWh/yr	6,880,787 kWh/yr
Energy Savings	62%	59%
Savings Amount (per year)	US\$686,222	US\$659,504

CO₂ Emissions Comparison (MVD vs. Damper)

Motor	FDF 1	FDF 2
Damper	10,549 tons/yr	10,638 tons/yr
MVD	4,041 tons/yr	4,383 tons/yr
Reduction	6,508 tons/yr	6,255 tons/yr
	62%	59%

Typical MVD System



Delta MVD 1000 Advantages

The Delta MVD 1000 is easy to operate and maintain, and offers special features for integration into a broad range of applications.

System Cooling Blowers

- Effective air-cooling design.
- Easy maintenance.

Transformer Cabinet

- The transformer secondary windings provide isolated phase-shifted power for improved current waveforms and lower grid harmonic distortion.
- Cooling fans specifically for transformer.



Bypass Cabinet

Manual or synchronous transfer bypass cabinets.

Controller Cabinet

- Touch screen display for monitoring and parameter setting.
- I/O boards with digital and analogue signals for various application requirements.
- Main controller rack, PLC, auxiliary power, UPS, and wiring.

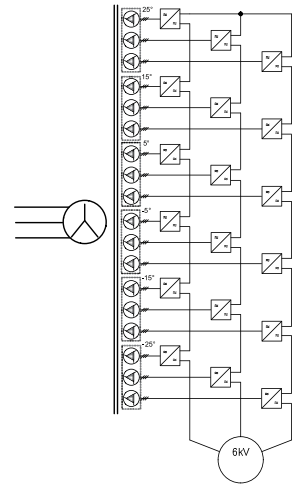
Power Cell Cabinet

- Modular design of power cell allows easy interchange and maintenance.
- Optical interface with main controller cabinet.

System Architecture

- IGBT-Based power cells in series connection to achieve working voltage
- Modular design with high flexibility & availability
- Extremely low motor and AC line current harmonics
- Fast transient response and wide motor frequency range
- N+1 redundant power cells

	Cells/Phase	Cells/System
3.3 kV	3	9
4.16 kV	4	12
6.6 kV	5/6	15/18
10 kV	9	27



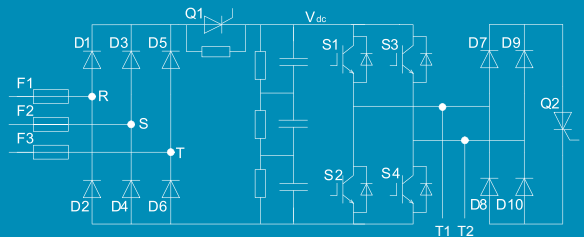
Power Cell Topology

Consists of three main circuits

- Three phase diode rectifying circuit
- DC capacitor for energy storage
- IGBT inverting circuit

Advantages

- Compact size
- Simple
- Easier installation and maintenance



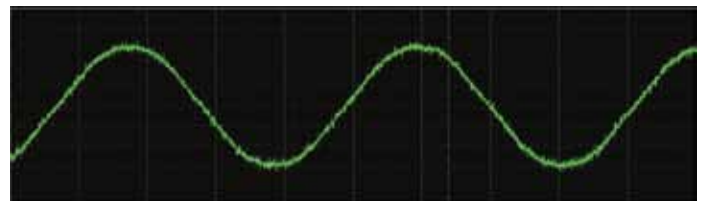
High Input / Output Power Quality

Low In / out Harmonics (10kV)

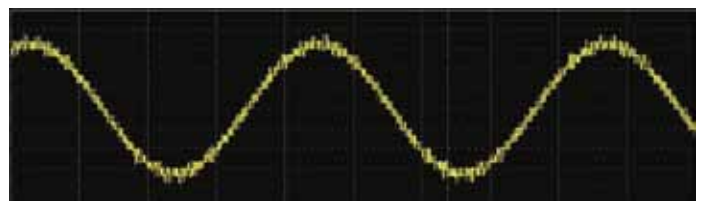
- 0.5% / Output current distortion
- 0.25% / Output voltage distortion
- 1.06% / Input current distortion

Almost Sine Wave Output

- No extra output filter required
- Applicable for induction or synchronous motor
- No need for motor derating operation
- Low dv/dt, avoid damaging insulation of motor and cables
- No torque ripple induced by harmonics
- Cable length limited by voltage drop



Output current waveform

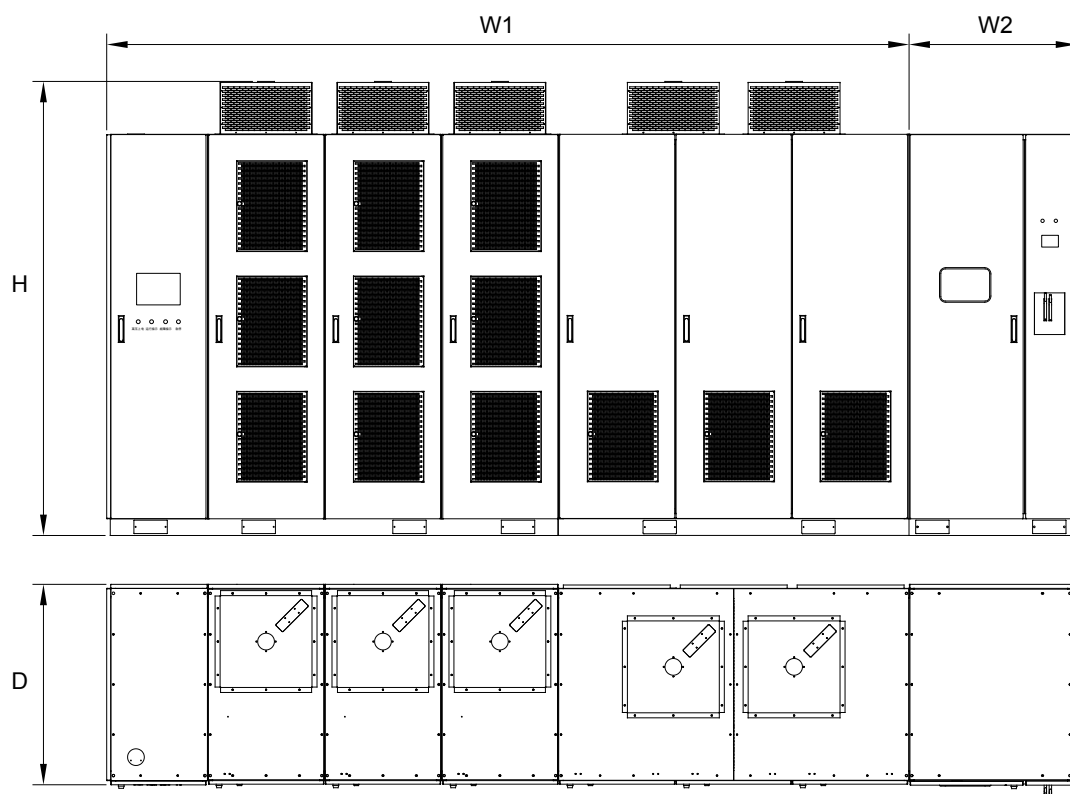


Output voltage waveform



Dimensions

Front Panel



Output kVA

Power Cell	3.3 kV	4.16 kV	6 kV	6.6 kV	10 kV	11 kV
Output Current (A)	Output Power (kVA)	Output Power (kVA)	Output Power (kVA)	Output Power (kVA)	Output Power (kVA)	Output Power (kVA)
50	280	360	520	570	860	950
70	400	500	720	800	1210	1330
120	680	860	1240	1370	2070	2280
190	1080	1360	1970	2170	3290	3620
250	1420	1800	2590	2850	4330	4760
305	1740	2190	3170	3480	5280	5810
400	2280	2880	4150	4570	6920	7620
500	2850	3600	5190	5710	8660	9520

Motor kW

Power Cell	3.3 kV	4.16 kV	6 kV	6.6 kV	10 kV	11 kV
Motor Current (A)	Motor Shaft Power (kW)	Motor Shaft Power (kW)	Motor Shaft Power (kW)	Motor Shaft Power (kW)	Motor Shaft Power (kW)	Motor Shaft Power (kW)
50	220	280	410	450	690	760
70	320	400	580	640	970	1060
120	540	690	990	1090	1660	1820
190	860	1090	1580	1730	2630	2890
250	1140	1440	2070	2280	3460	3810
305	1390	1750	2530	2780	4220	4640
400	1820	2300	3320	3650	5540	6090
500	2280	2880	4150	4570	6920	7620

Reliability & Certification

Delta provides quality assurance through rigorous inspection and testing based on international standards. To ensure that the motor drive operates as predicted upon start-up, Delta Electronics has built a state-of-the-art, multi-megawatt test facility for full load capacity and burn-in verification. A detailed test procedure reduces start-up time during installation and commissioning in the field.

Advanced Testing



• High Voltage Distribution Cabinet



• Low voltage inverter (re-generation)



• Central Control Room



• Thermal Chamber



• Motor-Generator Group

International Certification



Iso 9001:2008



Iso 14001:2004



OHSAS 18001:2007



QC 080000:2007



TL 9000 R5.0

Delta MVD 1000 Specifications

Input Frequency	50 Hz / 60 Hz (-2% ~ +2%)
Pulse Width Modulation	SVPWM
Control Power	3 phase 380 V or AC 220 V; 2.5 kVA
Input Power Factor	0.96 at full load and speed
Efficiency	> 96.5% at rated load and speed
Output Frequency	0-75 Hz
Frequency Setting Resolution	0.01 Hz
Over-current Protection	200% (can be customized)
Overload Ability	120% of rated current for 1 min every 10 min 150% shut down immediately
Current Limit	10-150% programmable
Analog Inputs	2 channels, 4-20 mA
Analog Outputs	4 channels, 4-20 mA
Communication	Standard: Modbus RTU / Options: Profibus DP & Ethernet/IP
Acceleration/ Deceleration Time	0-3000 seconds
Digital Inputs/Outputs	10 / 8 channels (extensible)
Operating Temperature	-5~45°C, normal operation / 45~55°C, derating operation
Storage Temperature	-40~70°C
Cooling	Forced air cooling
Humidity	< 95% with no condensation
Altitude	< 1000m, normal operation / 1000-2000 m, derating operation
Dust	Non-conductive, Non-corrosive, < 6.5 mg/m3
IP Class	IP20



Input Voltage:

3.3 kV~11 kV
(-/+10%)

Motor Shaft Power:

3.3 kV: 220-2280 kW
6 kV: 410-4150 kW
10 kV: 690-6920 kW

4.16 kV: 280-2880 kW
6.6 kV: 450-4570 kW
11 kV: 760-7620 kW

Compliance & Standards

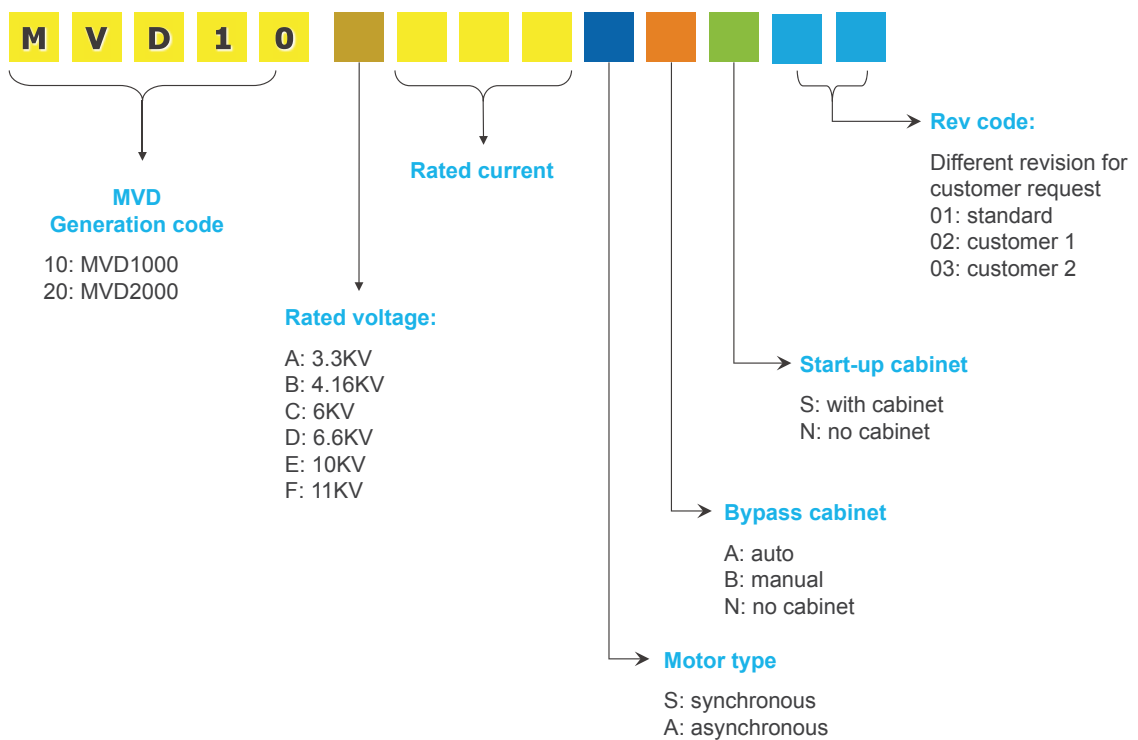
GB 156-2007	Standard voltages
GB/T 1980-2005	Standard frequencies
GB/T 2423.10	Electric and electronic products--Basic environmental test regulations for electricians--Guidelines for vibration (sine)
GB/T 2681	Colors of insulated conductors used in electrical assembly devices
GB 2682	Colors of indicator lights and push-buttons used in electrical assembly devices
GB/T 4588.1-1996	Specification for single and double sided printed boards with plain holes
GB/T 4588.2-1996	Sectional specification: Single and double sided printed boards with plated-through holes
GB 7678-87	Semiconductor self-commutated converters
GB 10233-88	Basic test method for electric-driven control gear assemblies
GB 12668-90	General specification for speed control assembly with semiconductor adjustable frequency for A.C. motor
GB/T 15139-94	General technical standard for electrical equipment structure
GB/ 13422-92	Power semiconductor converters--Electrical test methods
GB/T 14549-93	Quality of electric energy supply harmonics in public supply network
IEEE 519-1992	Practices and requirements for harmonic control in electrical power systems
GB/T 12668.4-2006	Adjustable speed electrical power drive systems. Part 4: General requirements. Rating specifications for A.C. power drive systems above 1000 V A.C. and not exceeding 35 kV
GB 3797-2005	Electric-driven control gear--Part 2: Electric-driven control gear incorporating electronic devices
GB/T 2900.18-2008	Electrotechnical terminology--Low voltage apparatus (eqv IEC60050-441:1984)
GB/T 3859.1-1993	Semiconductor converters. Specification of basic requirements--eqv IEC60146-1 -1:1991)
GB/T 3859.2-1993	Semiconductor converters. Application guide (eqv IEC60146-1-2:1991)
GB/T 3859.3-1993	Semiconductor converters. Transformers and reactors (eqv IEC 60146-1-3,1991)
GB 4208-2008	Degrees of protection provided by enclosures (IP Code) (eqv IEC 60529:1989)
GB/T 16935.1-2008	Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests (idt IEC 60664-1-1992)
IEC 60038:1983	IEC Standard voltages
IEC 60050-151:2001	International electrotechnical vocabulary, chapter 151: electrical and magnetic devices.
IEC 60050-551:1999	International Electrotechnical Vocabulary. Chapter 551: Power electronics.
IEC 60076	Electric power transformer
IEC 60721-3-1:1997	Classification of environmental conditions Part 3: classification of groups of environmental parameters and their severities, storage.
IEC 60721-3-2:1997	Classification of environmental conditions Part 3. Classification of groups of environmental parameters and their severities.
IEC 60721-3-3:2008	Classification of environmental conditions Part 3. Classification of groups of environmental parameters and their severities. Stationary use at weather protected locations.
IEC 61000-2-4:2002	Electromagnetic compatibility (EMC) Part 2- Environment chapter 4- Compatibility levels in industrial equipments for low-frequency conducted disturbances.
IEC 61000-4-7:2002	Electromagnetic compatibility (EMC) Part 4: Testing and measurement techniques chapter 7. General guide on harmonics and inter-harmonics measurements and instrumentation, for power supply systems and equipment connected.
IEC 61800-3:2004	Adjustable speed electrical power drive systems Part 3: product standard including specific test methods.
IEC 60757-1983	Identification of insulated and bare conductors by colors.
IEC 61800-5-1	Adjustable speed electrical power drive systems - Part 5-1: Safety requirements--Electrical, thermal and energy.

Global Sales & Service

Delta Electronics has sales and service locations around the world.



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